20111101 152400

FIG. 1

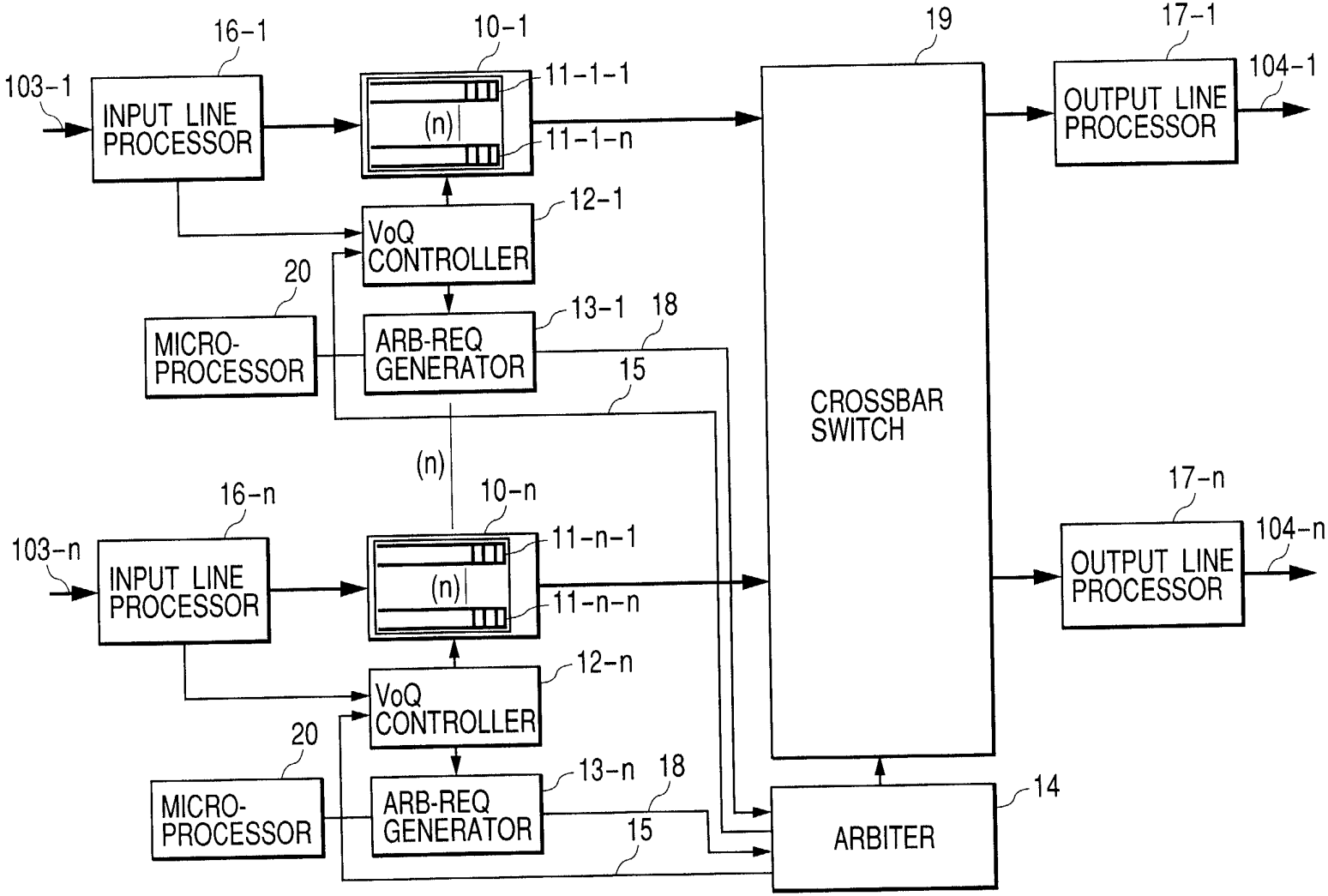


FIG. 2

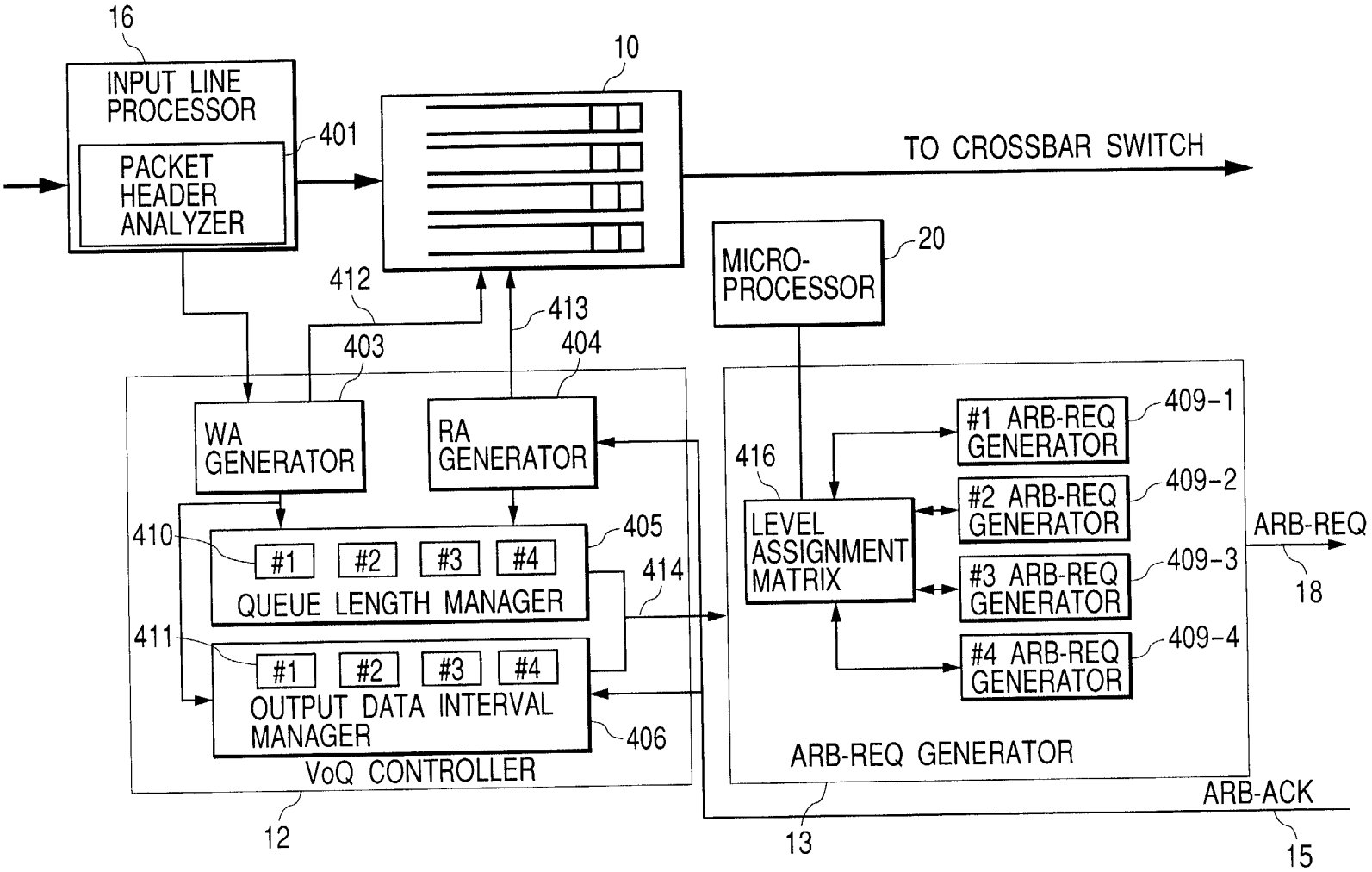

16
INPUT LINE PROCESSOR
PACKET HEADER ANALYZER
401
10
TO CROSSBAR SWITCH
MICRO-PROCESSOR
20
412
413
403
404
WA GENERATOR
RA GENERATOR
410
#1
#2
#3
#4
QUEUE LENGTH MANAGER
405
414
411
OUTPUT DATA INTERVAL MANAGER
406
VoQ CONTROLLER
12
416
LEVEL ASSIGNMENT MATRIX
#1 ARB-REQ GENERATOR
409-1
#2 ARB-REQ GENERATOR
409-2
#3 ARB-REQ GENERATOR
409-3
#4 ARB-REQ GENERATOR
409-4
ARB-REQ
18
ARB-REQ GENERATOR
13
ARB-ACK
15

FIG. 3

VoQ LEVEL ASSIGNMENT MATRIX

71

SEGMENT TRANSFER INTERVAL

72

THE NUMBER OF SEGMENTS IN VoQ

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	6	6	7	9	15	15
2	5	5	5	5	5	5	5	5	5	6	6	6	6	7	7	8	9	11	15	15	15
3	5	5	5	5	6	6	6	6	6	7	7	7	8	8	9	10	12	15	15	15	15
4	6	6	6	6	6	6	7	7	7	7	8	8	9	10	11	12	15	15	15	15	15
5	6	6	7	7	7	7	7	8	8	8	9	9	10	11	13	15	15	15	15	15	15
6	7	7	7	7	8	8	8	8	9	9	10	11	12	13	15	15	15	15	15	15	15
7	7	8	8	8	8	9	9	9	10	10	11	12	13	15	15	15	15	15	15	15	15
8	8	8	8	9	9	9	10	10	11	11	12	13	15	15	15	15	15	15	15	15	15
9	8	9	9	9	10	10	10	11	12	12	14	15	15	15	15	15	15	15	15	15	15
10	9	9	9	10	10	11	11	12	13	14	15	15	15	15	15	15	15	15	15	15	15
11	9	10	10	10	11	11	12	13	14	15	15	15	15	15	15	15	15	15	15	15	15
12	10	10	11	11	12	12	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15
13	10	11	11	12	12	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15
14	11	11	12	13	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
15	12	12	13	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
16	12	13	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
17	13	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
18	14	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
19	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
20	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15

FIG. 4

VoQ LEVEL ASSIGNMENT MATRIX

71

SEGMENT TRANSFER INTERVAL

72

THE NUMBER OF SEGMENTS IN VoQ

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	4	4	4	4	4	5	5	5	6	9	15	15	15	15	15	15	15	15	15	15	15
2	5	5	5	5	5	6	6	7	9	15	15	15	15	15	15	15	15	15	15	15	15
3	5	5	6	6	6	7	8	9	12	15	15	15	15	15	15	15	15	15	15	15	15
4	6	6	6	7	7	8	9	11	15	15	15	15	15	15	15	15	15	15	15	15	15
5	6	7	7	7	8	9	10	13	15	15	15	15	15	15	15	15	15	15	15	15	15
6	7	7	8	8	9	10	12	15	15	15	15	15	15	15	15	15	15	15	15	15	15
7	7	8	8	9	10	11	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15
8	8	8	9	10	11	12	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
9	8	9	10	10	12	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
10	9	9	10	11	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
11	9	10	11	12	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
12	10	11	12	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
13	10	11	12	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
14	11	12	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
15	12	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
16	12	13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
17	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
18	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
19	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
20	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15

FIG. 5

VoQ LEVEL ASSIGNMENT MATRIX

71

SEGMENT TRANSFER INTERVAL

72

THE NUMBER OF SEGMENTS IN VoQ

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	5	5	5	5	5	5	5	5	5	6	6	6	6	7	7	8	9	11	15	15	15
2	6	6	6	6	6	6	7	7	7	7	8	8	9	10	11	12	15	15	15	15	15
3	7	7	7	7	8	8	8	8	9	9	10	11	12	13	15	15	15	15	15	15	15
4	8	8	8	9	9	9	10	10	11	11	12	13	15	15	15	15	15	15	15	15	15
5	9	9	9	10	10	11	11	12	13	14	15	15	15	15	15	15	15	15	15	15	15
6	10	10	11	11	12	12	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15
7	11	11	12	13	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
8	12	13	13	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
9	14	14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
10	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
11	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
12	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
13	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
14	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
16	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
17	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
18	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
19	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15
20	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15

FIG. 6

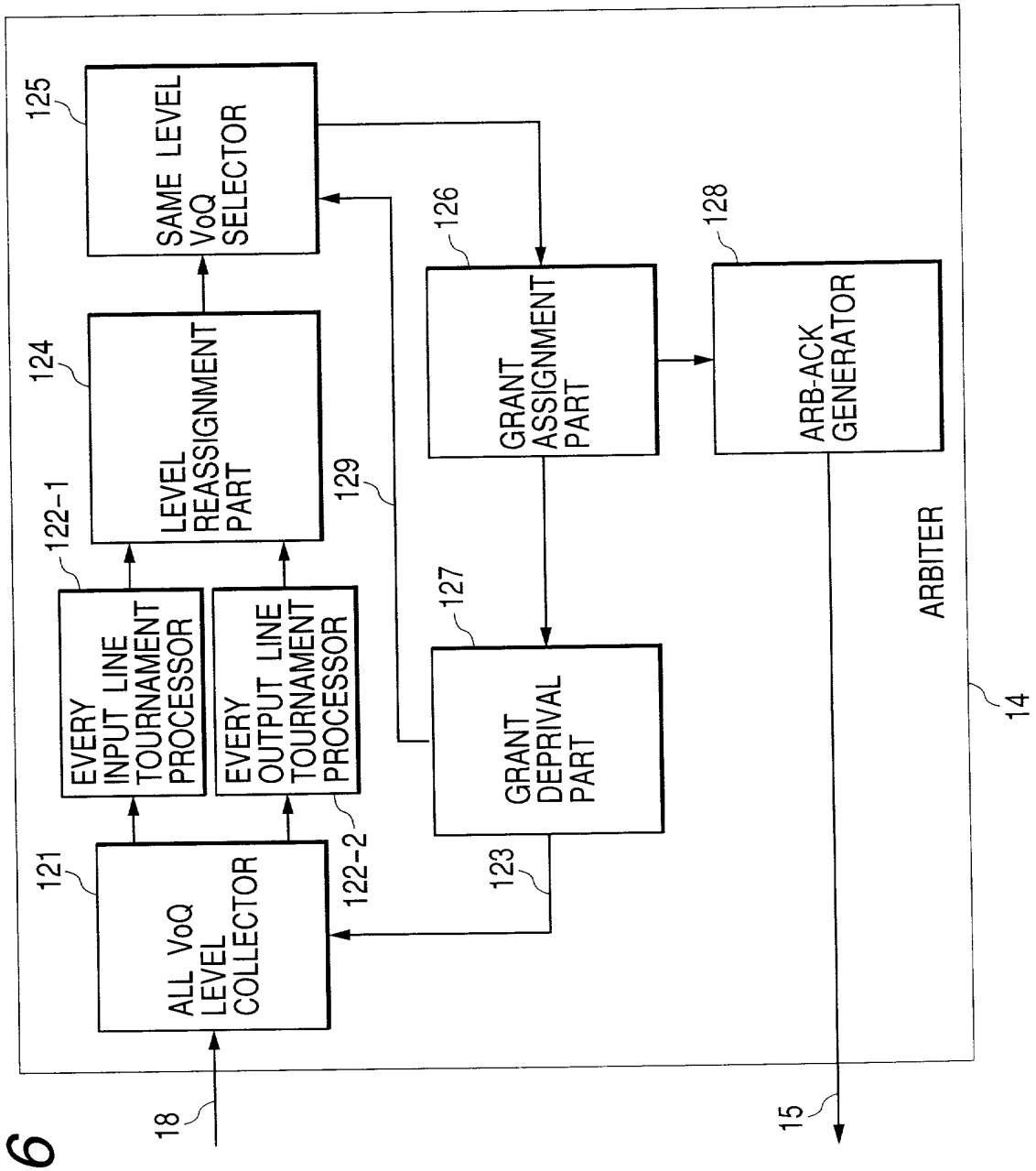

ARBITER
14
18
15
ALL VoQ LEVEL COLLECTOR
121
EVERY INPUT LINE TOURNAMENT PROCESSOR
EVERY OUTPUT LINE TOURNAMENT PROCESSOR
122-1
122-2
LEVEL REASSIGNMENT PART
124
SAME LEVEL VoQ SELECTOR
125
GRANT ASSIGNMENT PART
126
GRANT DEPRIVAL PART
127
ARB-ACK GENERATOR
128
123
129

FIG. 7

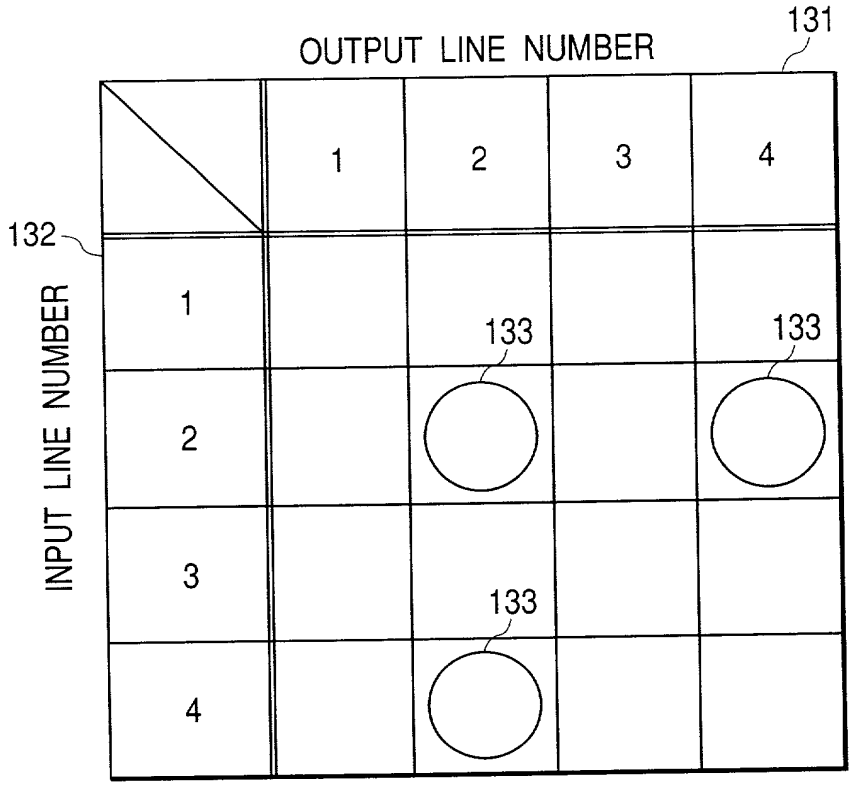

131
OUTPUT LINE NUMBER
1
2
3
4
132
INPUT LINE NUMBER
1
2
3
4
133
133
133

FIG. 8

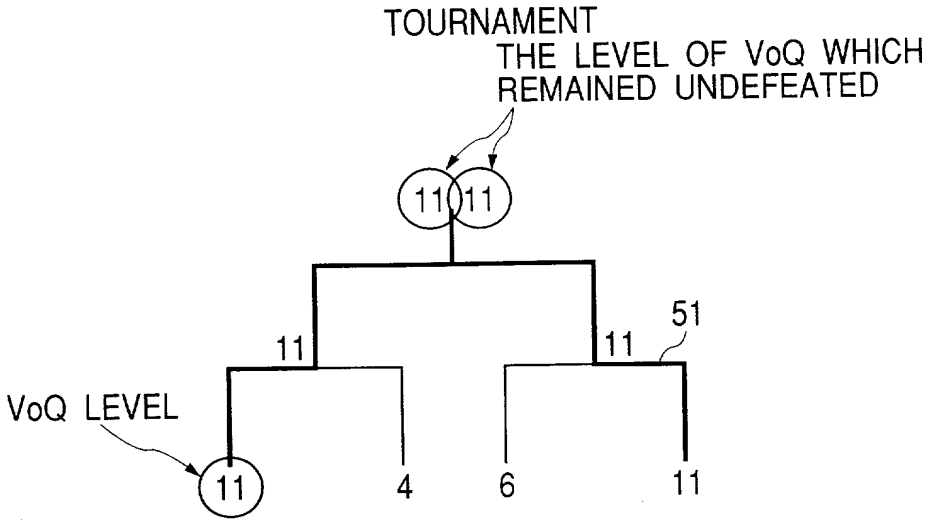

TOURNAMENT
THE LEVEL OF VoQ WHICH REMAINED UNDEFEATED
11
11
11
11
51
VoQ LEVEL
11
4
6
11

FIG. 9

141

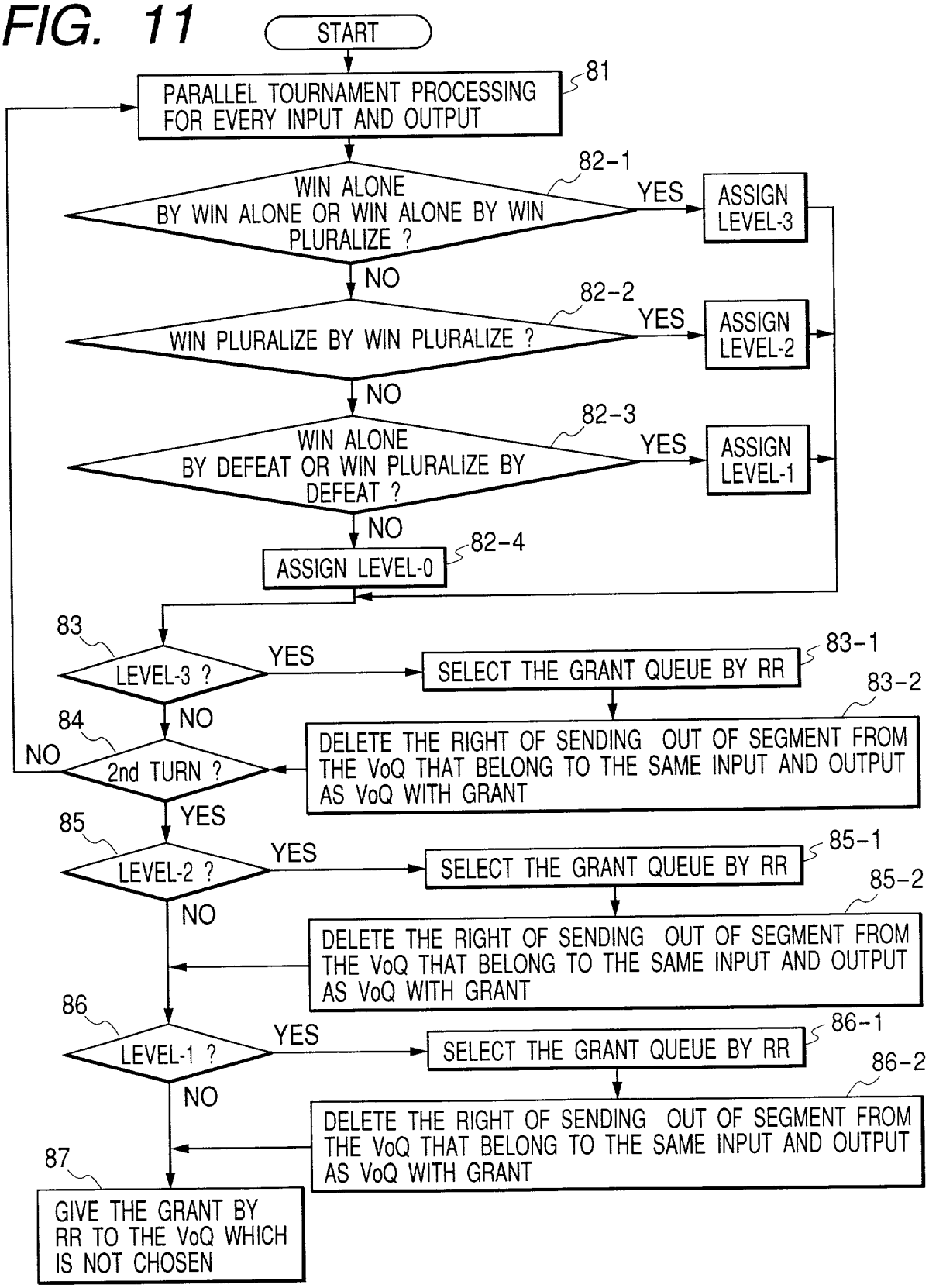
INPUT LINE DIRECTION	OUTPUT LINE DIRECTION
WIN ALONE	WIN ALONE
WIN ALONE	WIN PLURALIZE
WIN PLURALIZE	WIN ALONE
WIN ALONE	DEFEAT
WIN PLURALIZE	DEFEAT
DEFEAT	WIN ALONE
DEFEAT	WIN PLURALIZE
DEFEAT	DEFEAT

FIG. 10

LEVEL REASSIGNMENT TABLE 61

	WIN ALONE	WIN PLURALIZE	DEFEAT
WIN ALONE	LEVEL 3	LEVEL 3	LEVEL 1
WIN PLURALIZE	LEVEL 3	LEVEL 2	LEVEL 1
DEFEAT	LEVEL 1	LEVEL 1	LEVEL 0

FIG. 11


START
PARALLEL TOURNAMENT PROCESSING FOR EVERY INPUT AND OUTPUT
81
WIN ALONE BY WIN ALONE OR WIN ALONE BY WIN PLURALIZE ?
82-1
YES
ASSIGN LEVEL-3
NO
WIN PLURALIZE BY WIN PLURALIZE ?
82-2
YES
ASSIGN LEVEL-2
NO
WIN ALONE BY DEFEAT OR WIN PLURALIZE BY DEFEAT ?
82-3
YES
ASSIGN LEVEL-1
NO
ASSIGN LEVEL-0
82-4
83
LEVEL-3 ?
YES
SELECT THE GRANT QUEUE BY RR
83-1
NO
84
2nd TURN ?
NO
DELETE THE RIGHT OF SENDING OUT OF SEGMENT FROM THE VoQ THAT BELONG TO THE SAME INPUT AND OUTPUT AS VoQ WITH GRANT
83-2
YES
85
LEVEL-2 ?
YES
SELECT THE GRANT QUEUE BY RR
85-1
NO
DELETE THE RIGHT OF SENDING OUT OF SEGMENT FROM THE VoQ THAT BELONG TO THE SAME INPUT AND OUTPUT AS VoQ WITH GRANT
85-2
86
LEVEL-1 ?
YES
SELECT THE GRANT QUEUE BY RR
86-1
NO
DELETE THE RIGHT OF SENDING OUT OF SEGMENT FROM THE VoQ THAT BELONG TO THE SAME INPUT AND OUTPUT AS VoQ WITH GRANT
86-2
87
GIVE THE GRANT BY RR TO THE VoQ WHICH IS NOT CHOSEN

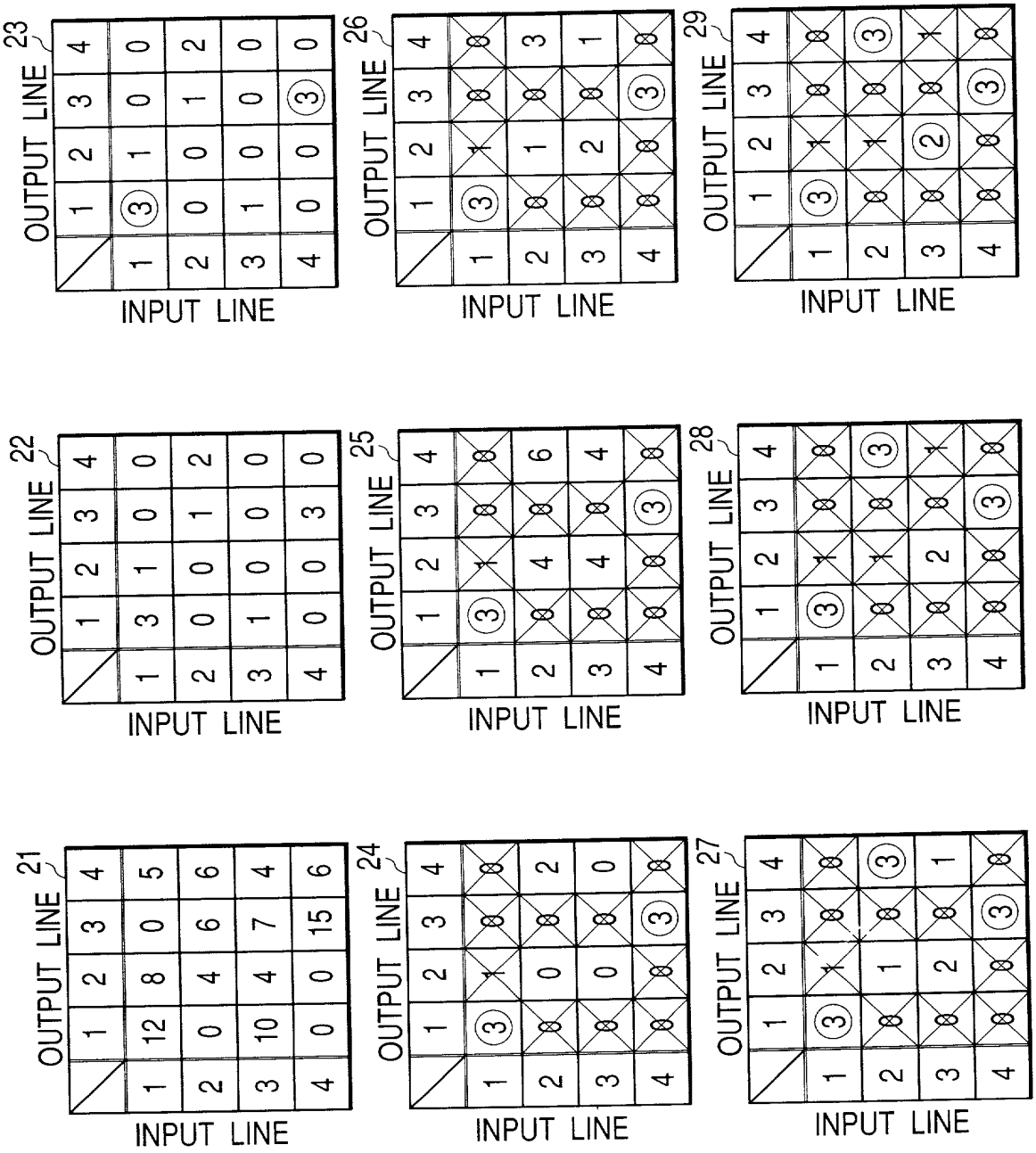

21
OUTPUT LINE
INPUT LINE
22
OUTPUT LINE
INPUT LINE
23
OUTPUT LINE
INPUT LINE
24
OUTPUT LINE
INPUT LINE
25
OUTPUT LINE
INPUT LINE
26
OUTPUT LINE
INPUT LINE
27
OUTPUT LINE
INPUT LINE
28
OUTPUT LINE
INPUT LINE
29
OUTPUT LINE
INPUT LINE

FIG. 12

FIG. 13

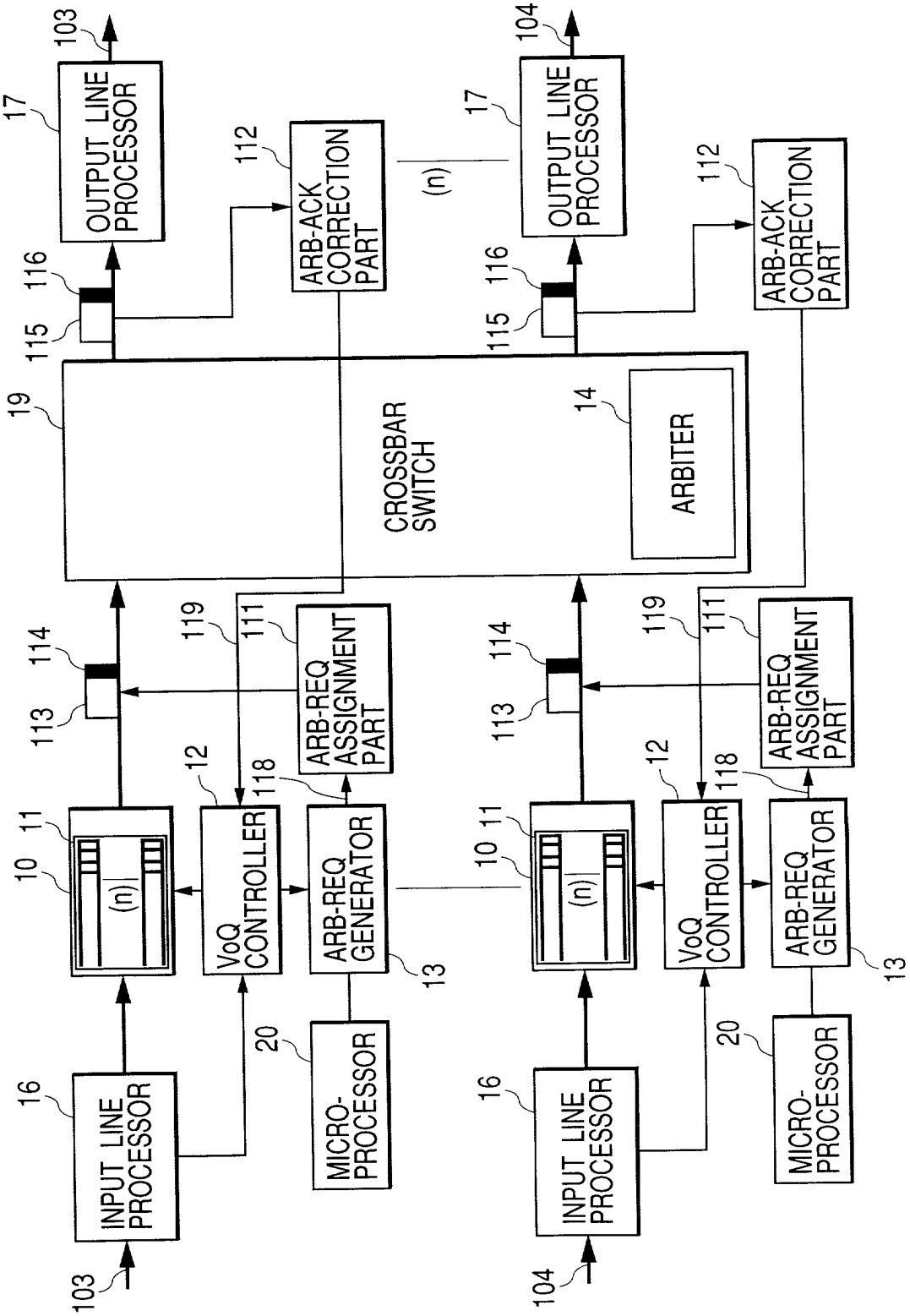

INPUT LINE PROCESSOR
MICRO-PROCESSOR
VoQ CONTROLLER
ARB-REQ GENERATOR
ARB-REQ ASSIGNMENT PART
ARB-ACK CORRECTION PART
OUTPUT LINE PROCESSOR
CROSSBAR SWITCH
ARBITER
(n)
103
104
10
11
12
13
14
16
17
19
20
111
112
113
114
115
116
118
119

FIG. 14

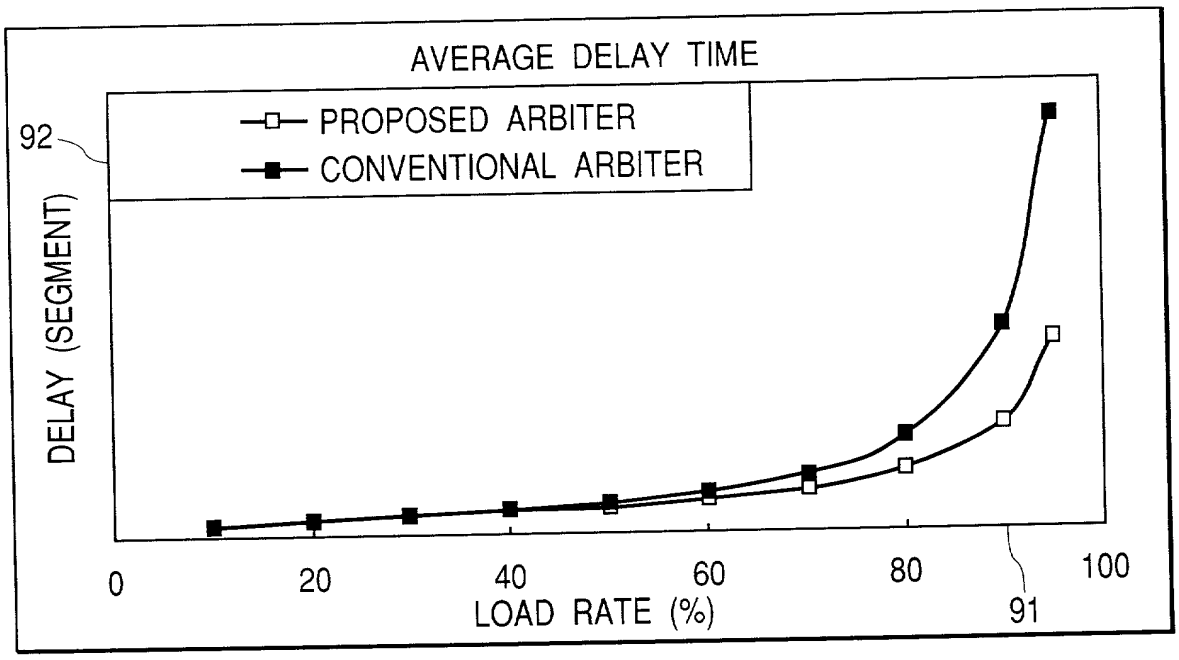
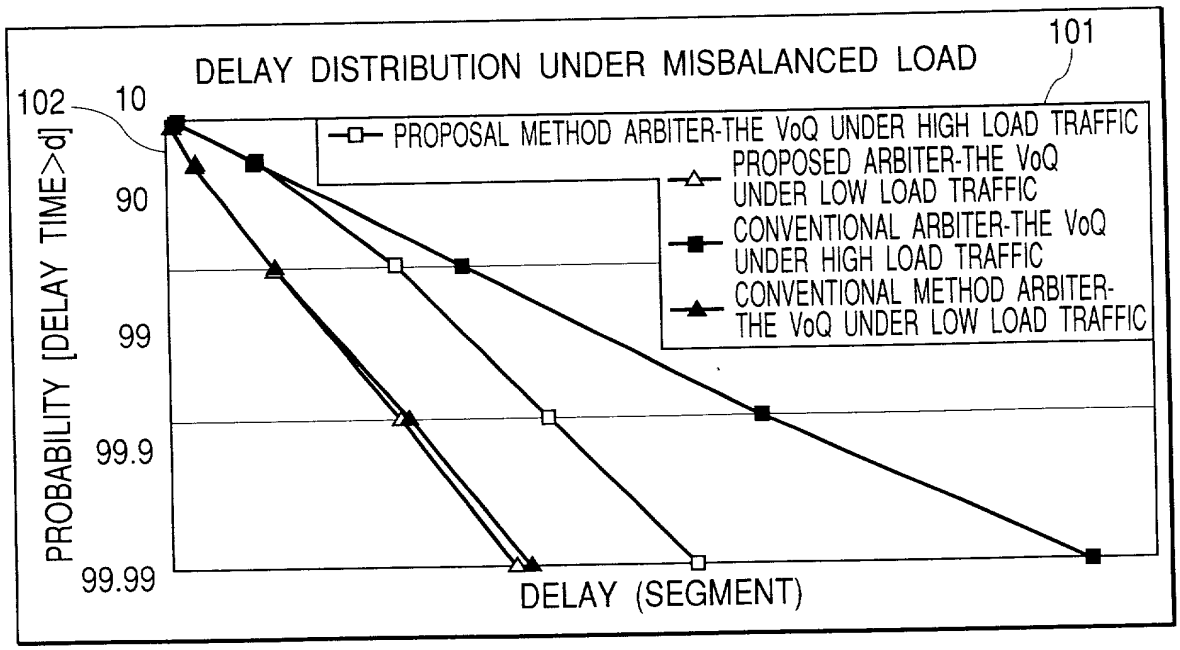

AVERAGE DELAY TIME
PROPOSED ARBITER
CONVENTIONAL ARBITER
92
DELAY (SEGMENT)
0
20
40
60
80
100
91
LOAD RATE (%)

FIG. 15


DELAY DISTRIBUTION UNDER MISBALANCED LOAD
101
102
PROBABILITY [DELAY TIME>d]
10
90
99
99.9
99.99
PROPOSAL METHOD ARBITER-THE VoQ UNDER HIGH LOAD TRAFFIC
PROPOSED ARBITER-THE VoQ UNDER LOW LOAD TRAFFIC
CONVENTIONAL ARBITER-THE VoQ UNDER HIGH LOAD TRAFFIC
CONVENTIONAL METHOD ARBITER-THE VoQ UNDER LOW LOAD TRAFFIC
DELAY (SEGMENT)

20TTTO" TSEAHOOT

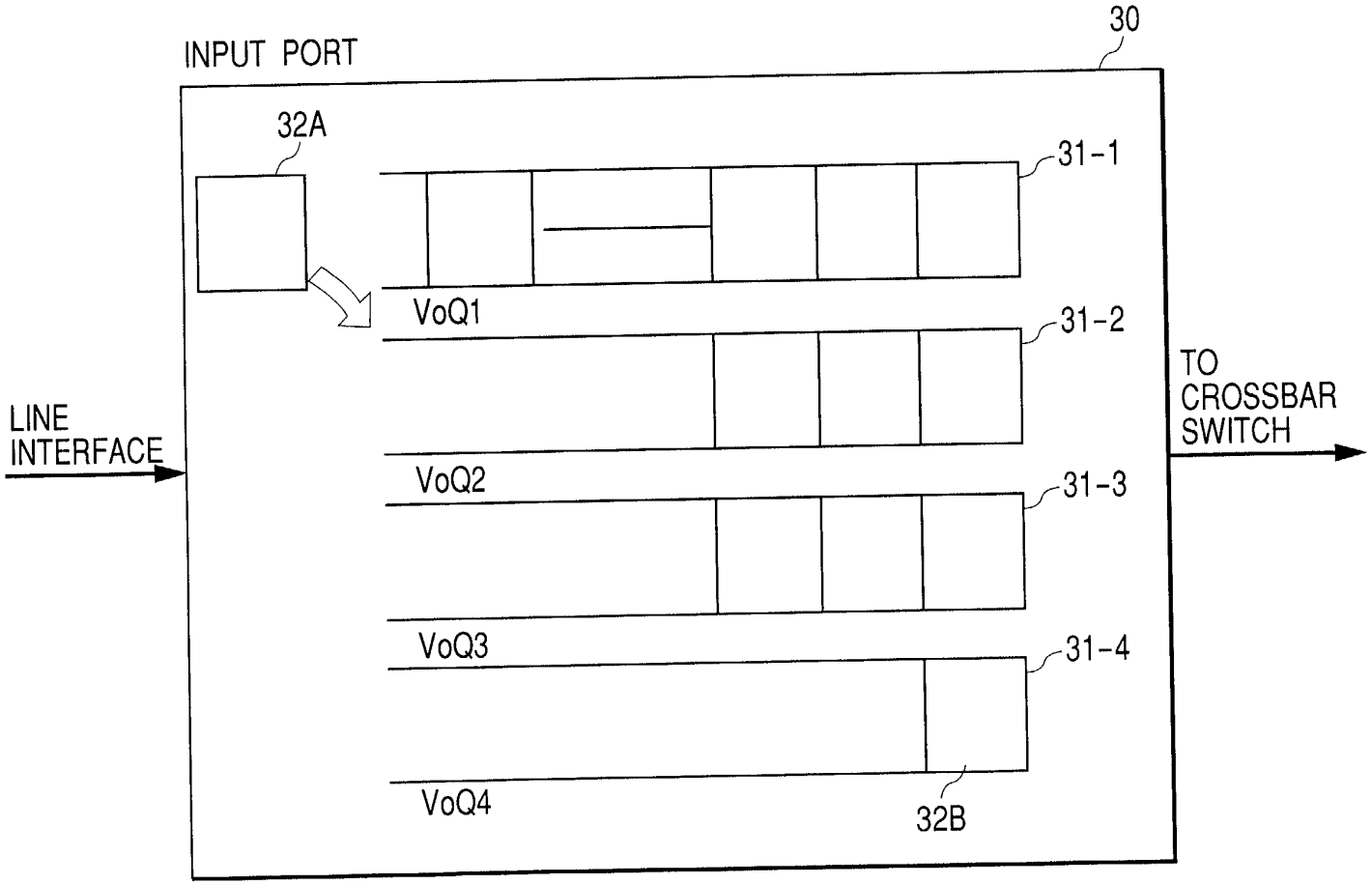



FIG. 16